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## ENUMERATION OF THE NORTH AMERICAN CERCOSPORÆ.

WITH DESCRIPTIONS OF THE SPECIES.

BY J. B. ELLIS AND B. M. EVERHART.

The genus *CERCOSPORA* which was established by Fresenius about thirty years ago, comprised at first only a few species, taken mostly from several other genera in which they did not seem properly to belong. In his *Beitrag zur Mycologie* (1863) he describes four species. Fuckel, in his *Symbolæ Mycologicæ* (1869), enumerates ten species. Saccardo, in the first volume of *Michelia*, mentions and describes thirty-eight species, and in the second volume (1882) adds about twenty more. Thirty-seven additional species have been described by Cooke in *Grevillea*. Peck, in the *Reports of the N. Y. State Museum* has added about a dozen, while Von Thumen, Dr. Winter, and various others, including the writers of this article, have further contributed to swell the number of published species, till the list has become almost formidable. And now, before this rapidly accumulating mass of new and old species shall become entirely unmanageable, we have thought it might be well to "take an account of stock," to see, if possible, how we stand. With this object in view, we have made this "Enumeration" of the species thus far described in this country. We have tried to reduce and condense the list as far as consistently could be done, and, if we have failed to do this satisfactorily our labor still will not be lost, for, by bringing the scattered fragments together into one body, we have made it easier for others to carry on and complete the work which is here begun.

*CERCOSPORA* (Gr. *kerkos* a tail, and *spora* a spore) is a genus of

Hypomycetous fungi growing mostly on living leaves, generally on dead or discolored spots, and consisting of little tufts of erect, brown, or sometimes nearly colorless (hyaline) threads (hyphæ) bearing terminal or (exceptionally) lateral, elongated, septate, pale brownish or hyaline spores (conidia) which are generally attenuated above. The hyphæ arise from a more or less distinct tubercular base and are generally undulate above or are abruptly bent this way and that, or imperfectly toothed and swollen at intervals (nodulose) and occasionally sparingly branched. The conidia are, for the most part, terminal, but occasionally arise also from little tooth-like projections on the sides of the hyphæ below the apex. They are cylindrical, hyaline and without septa (continuous) at first but soon become elongated and septate, and are usually attenuated above, often very distinctly so, and at maturity become slightly brownish, but in most of the species this brown tint is so faint that the conidia are called hyaline. There are, however, species with decidedly brown conidia (Nos. 25, 27, 101.)

CERCOSPORA is confluent on one side with *Helminthosporium* from which it differs in its less rigid and paler hyphæ and conidia, and on the other with *Ramularia* which has both hyphæ and conidia hyaline. Probably none of the species are autonomous, being apparently only the conidial stage of various species of *Sphaerella* or other sphæriaceous fungi.

Thanks are due to Dr. Geo. Martin, of West Chester, Pa., who has carefully examined many of the species here described and placed his notes at our disposal.

The species may be grouped, for convenience, according to the presence, absence, color, etc., of the spots.

A. Hyphæ brown.

- a. Spots orbicular or suborbicular, gray, cinereous or white, 1-19.
- b. " " " " brown, at least when young, 20-50.
- c. Spots angular or irregular, 51-65.
- d. Spots indefinite, 66-75.
- e. Spots none, or at least not very conspicuous.
  - a. Tufts scattered, 76-82.
  - b. Tufts effused, 83-101.

B. Hyphæ nearly hyaline (*Cercospora*ella, Sacc.), 102-108.

C. Species standing ambiguously between CERCOSPORA and RAMULARIA, 109 et seq.

A. Hyphæ brown.

- a. *Spots orbicular or suborbicular, gray, cinereous or white.*

1. CERCOSPORA FLAGELLARIS, E. & M., Am. Nat., Dec. '82, p. 1003. N. A. F., 1256.

Spots pallid-white (2-8 mm.) with a narrow, raised, reddish brown border, round or irregular, often confluent, mostly on withered parts of the leaf. Hyphæ tufted, brownish, undulate and nodulose above, 75-80

x 4  $\mu$ . Conidia slender, attenuated above, 8—10-septate, 80—112 x 4  $\mu$ . Amphigenous, but more perfectly developed on the lower surface of the leaf.

On leaves of *Phytolacca decandra*, from various localities.

2. CERCOSPORA DIANTHERÆ, E. & K., Jour. of Mycol. I, p. 2.

On round, white spots (2—4 mm.) and mostly included in or surrounded by brown, dead areas of the leaf which again are either indefinitely limited or are bounded by a definite, darker, narrow border. Tufts small, loose, spreading, of only a few threads each (3—12), on the white spots. Hyphæ brown, continuous or sparingly and faintly septate, geniculate and toothed above, 60—80 x 4  $\mu$ . Conidia slender, linear obclavate, 80—120 x 4—5  $\mu$ , multiseptate, hyaline. Allied to the preceding.

On leaves of *Dianthera Americana*, Sept., Kansas (Kellerman).

3. CERCOSPORA VIOLÆ, Sacc., F. Ven. nov. vel. crit., V. p. 187.

Spots suborbicular, dry and pale. Hyphæ amphigenous, short, simple, fuscous, 30—35 x 4  $\mu$ . Conidia very long, 150—200 x 3½  $\mu$ , wand-shaped, multiseptate, hyaline.

On leaves of Violet, August, N. Y. (Peck), Iowa (Holway):

4. CERCOSPORA CHENOPODII, Fres. Beitr. p. 92. Michelia, vol. II., p. 364. Exsiccati, de Thum, M. U., No. 374. Rav. Fungi Amer., 591. Ellis N. A. F., 550.

Hyphæ amphigenous, fasciculate, simple or 1-septate, 40—50 x 5—6  $\mu$ , brown. Conidia subcylindrical, ends subobtuse, slightly curved, 60—70 x 6—8  $\mu$ , 4—5-septate, with a brownish shade, on pale, thin, light-colored spots ¼—½ cm.

On leaves of *C. album* and probably other species of *Chenopodium*. Common.

5. CERCOSPORA PLANTAGINIS, Sacc., Mich. I., p. 267.

Spots small (1—2 mm.) round, white, thin with a narrow, reddish brown border. Hyphæ fasciculate, brown, septate, 40—60 x 3  $\mu$ , forming minute tufts. Conidia slender, obclavate, acute above, multiseptate, hyaline, 80—200 x 3—4  $\mu$ .

On leaves of *Plantago lanceolata*, Newfield, N. J., and also on *P. major*, Kansas (Kellerman).

6. CERCOSPORA PHYSALIDIS, Ell. Am., Nat., Oct., '82, p. 810.

Amphigenous; on white, round, deciduous spots, (1—3 mm.) Hyphæ fasciculate, brown, subnodulose, 45—55 x 5—5½  $\mu$ . Conidia clavate, cylindrical, faintly 5—8-septate, hyaline, 65—75 x 4  $\mu$ .

On leaves of several species of *Physalis*. From Kentucky and Kansas (Kellerman), to Wisconsin (Trelease).

7. CERCOSPORA EUONYMI, Ell. l. c. N. A. F. 1245.

Amphigenous; on small, round, white spots (1—2 mm.) with a dark purple border. Hyphæ fasciculate, subnodulose, brown, about 60  $\mu$  high. Conidia obclavate-cylindrical, 3—5-septate, hyaline, 50—65 x 7—8  $\mu$ .

On leaves of *Euonymus Americanus* and *E. Europæus*, Ky. (Kellerman)

8. *CERCOSPORA ASCLEPIADIS*, Ell. l. c. *C. venturioides*, Pk.? 34th Rep. N. Y. St. Mus., p. 47.

Amphigenous, but mostly epiphyllous, on suborbicular spots (1—3 mm.) black at first then becoming white in the center, with a definite dark brown or nearly black raised border around which the leaf is stained purplish brown. Hyphæ fasciculate, subnodulose, and sparingly subdentate above, brown, 40—50 x 4  $\mu$ . Conidia linear-obclavate, about 5-septate, hyaline, 80—120 x 3½—4  $\mu$ .

On *Asclepias Cornuti*. Quite different from *C. clavata*, Ger.

9. *CERCOSPORA TEUCRII*, E. & K. Bull. Torr. Bot. Club, vol. XI. p. 116.

Epiphyllous, on brown (1—2 mm.) spots which soon become dirty white with a dark purple shaded border. Hyphæ tufted, brown, crooked and subdenticulate above, 75—120 x 4  $\mu$ , faintly septate. Conidia long and slender, 75—120 x 3—4  $\mu$ , faintly septate.

On leaves of *Teucrium Canadense*, Aug., Kansas (Kellerman).

10. *CERCOSPORA ACALYPHÆ*, Pk. 34th Rep. N. Y. State Mus., p. 48.

Spots very small, orbicular, dry, whitish, with a narrow purplish brown border. Hyphæ epiphyllous, tufted, subflexuous, septate, colored, 54—75 x 5  $\mu$ . Conidia slender, rod-like, 5—7-septate, colorless, 50—100 x 3  $\mu$ .

On leaves of *Acalypha Virginica*. N. Y. (Pk.), Kansas (Kellerman).

11. *CERCOSPORA CITRULLINA*, Cke. Grev. XII. p. 31. Rav. F. Amer. 589.

Epiphyllous. Spots orbicular (2—4 mm.) whitish with a purple shaded border. Hyphæ pale-olivaceous, elongated. Conidia very long, attenuated above, sparingly septate, hyaline, 120—140 x 3  $\mu$ .

On leaves of watermelon. S. Carolina (Ravenel).

12. *CERCOSPORA BETICOLA*, Sacc. Fungi Ven. nov. vel. crit. Ser. V. p. 189. N. A. F., No. 48.

Amphigenous. Spots suborbicular arid, grayish (2—3 mm.) with a purplish border. Hyphæ fasciculate, mostly without septa, 40—50 x 4—5  $\mu$ , brownish, nodulose above. Conidia narrow, linear, multiseptate, hyaline, 70—120 x 3  $\mu$ .

On leaves of cultivated beet. Common.

13. *CERCOSPORA ANTIPUS*, Ell. & Hol. Jour. of Mycol. I. p. 5.

Amphigenous but mostly hypophyllous, on round (3—4 mm.) spots, dirty gray above and ferrugineous-brown below, with a rather broad, raised, dark colored border. Hyphæ fasciculate, brown, undulate and subgeniculate, imperfectly toothed above; conidia cylindrical or clavate-cylindrical with a pale yellowish tint, becoming faintly 3—5-septate, 30—40 x 2½ x 3  $\mu$ . *Sphaerella Clymenia*, Sacc. occurs on the upper surface of the spots.

On leaves of *Lonicera flava*, August, Iowa (Holway).

14. *CERCOSPORA ZINNIAE*, E. & M. n. s.

Spots ¼—½ cm. across, consisting of a small (1—1½ mm.) white center

with an indefinite, dirty red-brown margin—or oftener on the brown area appear many small, white, round spots which become at length more or less confluent. Hyphæ epiphyllous, fasciculate, brown, continuous or sparingly septate, 40—60 x 4—5  $\mu$ , abruptly bent and crooked above. Conidia oblong or cylindrical, 1—2-septate, 16—30 x 4  $\mu$ , hyaline.

On leaves of *Zinnia multiflora*, Florida (Dr. Martin).

15. CERCOSPORA ISANTHI, E. & K. Bull. Torr. Bot. Club, XI. p. 115.

On round (1 mm.) white spots, with a narrow raised border. Hyphæ tufted (25—30 x 4  $\mu$ ), crooked and subdentate above, continuous, brown. Conidia clavate-cylindrical, multiseptate, 75—100 x 3—4  $\mu$ . The spots are at first purplish, with a purple shaded border but soon whiten out.

On leaves of *Isanthus cæruleus*, Manhattan, Kas. Aug. (Kellerman).

16. CERCOSPORA CROTONIFOLIA, Cke. Grev. XII. p. 31. Rav. F. Amer. 593.

Hyphæ epiphyllous, short or obsolete, on round, light colored definite spots (3—4 mm.) Conidia cylindrical, straight, subobtuse, 1—3-septate, hyaline, 28—40 x 3  $\mu$ .

On leaves of *Croton glandulosum*. S. Carolina (Ravenel). This has the general appearance of *C. Chenopodii*, Fres.

17. CERCOSPORA RESEDÆ, Fuckl. Symbolæ Myc., p. 353. N. A. F., 375. *Virgasporium maculatum*, Cke., Grev. III. p. 182., id. IV. p. 69.

Spots pallid, arid, round, (2—4 mm.) with a slightly raised, pale border. Hyphæ amphigenous, cæspitose, simple, continuous or faintly septate, nearly straight below but more or less crooked and irregular above, fuscous, 50—70 x 4—5  $\mu$ , forming little grayish tufts thickly scattered over the central part of the spots. Conidia linear-obclavate, 4-5-septate, 100—140 x 2½—3  $\mu$ , hyaline.

On living leaves of *Reseda odorata*, Penn. (Martin).

18. CERCOSPORA CANESCENS, E. & M. Am. Nat., Dec. '82, p. 1003. N. A. F., 1249.

Spots brown, becoming gray and dirty white, suborbicular, irregular and confluent (¼—½ cm.), mostly on dead portions of the leaf, mostly with a narrow, definite, reddish brown border on the upper side of the leaf. Hyphæ cæspitose, brown, 90—110 x 5—6  $\mu$ , forming little black tufts. Conidia obclavate-cylindrical, 5—8-septate, hyaline, 100—120 x 5—6  $\mu$ , mostly epiphyllous.

On leaves of *Phaseolus* (cult.) Newfield, N. J.

19. CERCOSPORA VERNONIÆ, E. & K. Am. Nat., Nov. '83, p. 1166.

Epiphyllous, on small (1—3 mm.) round, gray or purplish gray spots (which finally whiten out) with a distinct, narrow, raised border which is surrounded by a purplish discoloration. Hyphæ cæspitose, subfuscous, continuous, subnodulose and subdenticulate above, 25—40 x 4—5  $\mu$ . Conidia slender, clavate, 6—9-septate, 75—100 x 3—4  $\mu$ .

On leaves of *Vernonia Baldwinii*, Kansas (Kellerman).

This differs from *C. oculata*, E. & K., in the different character of the spots and its longer and more distinctly septate conidia.

b. . *Spots orbicular or suborbicular, brown.*

20. *CERCOSPORA OCLATA*, E. & K. Bull. Torr. Bot. Club, XI. p. 116.

Mostly epiphyllous, on dirty brown spots (.25-.75 cm.) with a definite, slightly raised, narrow, darker border; hyphæ cæspitose, short (25—30 x 4  $\mu$ ) obtuse, simple, brown, continuous, entire or slightly denticulate above; conidia at first oblong and 1-septate, 20—30  $\mu$  long, at length attenuated below and becoming 30—60 x 3—4  $\mu$  and faintly 3-septate.

The spots are often concentrically wrinkled and sometimes confluent, forming patches 2—3 cm. across.

On leaves of *Vernonia Baldwinii*. July. Kansas (Kellerman).

21. *CERCOSPORA CALLÆ*, Pk. & Clinton. 29th Rep. N. Y. State Mus. p. 52. N. A. F., No. 1253.

Spots definite, oblong, pale ( $\frac{1}{2}$ —1 x  $\frac{1}{4}$  cm.) with a reddish brown border. Hyphæ amphigenous, short, flexuous, somewhat nodulose, not at all or indistinctly septate, slightly colored, cinereous or subolivaceous in the mass, growing in minute, scattered tufts. Conidia cylindrical or obclavate, at first continuous then elongated and 1—5-septate, nearly straight, 30—75  $\mu$  long.

On living leaves of *Calla palustris*. Aug. Buffalo, N. Y. (Clinton).

Closely allied to *C. nymphaëacea*, C. & E., but readily distinguished even by the naked eye, by its *scattered* tufts of hyphæ.

22. *CERCOSPORA NYMPHÆACEA*, C. & E. Grev. VI. p. 89. N. A. F., No. 50.

Epiphyllous, on pale, suborbicular spots ( $\frac{1}{4}$ — $\frac{1}{2}$  cm.) with a narrow, slightly raised, reddish brown border. Hyphæ slender and nearly hyaline, collected in minute tufts so thickly scattered over the surface of the spots as to appear evenly effused. Conidia very slender, almost thread-like, multiseptate, hyaline (yellowish in the dry specimens) straight or curved 60—90  $\mu$  long. The fungus to the naked eye is lead colored. In the dry specimens the spots are concave above and convex below.

On leaves of *Nymphaea odorata*, Newfield, N. J.

23. *CERCOSPORA RUBELLA*, Cke. Grev. VII. p. 34. Rav. F. Amer. 289.

Hyphæ epiphyllous (amphigenous?) subfasciculate, brown, on rusty red spots and areas of the leaves, bounded by a narrow, raised border. Conidia cylindrical, attenuated above, hyaline, 1—2-septate, 30—50  $\mu$  long.

On leaves of *Eriogonum tomentosum*, S. Carolina (Ravenel.)

24. *CERCOSPORA CEPHALANTHI*, E. & K. Bull. Torr. Bot. Club, XI, p. 121.

On orbicular (1—4 mm.) red-brown spots with narrow, dark, raised border. Hyphæ mostly epiphyllous, tufted, brown, continuous or faintly septate, 24—30 x 3—4  $\mu$ , at length elongated (40—56  $\mu$ ) and crooked or

undulate above. Conidia (mature?) subfuscous, oblong-cylindric, 20—30 x 3—4  $\mu$ , 1—3-septate

The tufts of hyphæ are very minute and meager, and are seen with difficulty. The conidia are not abundant.

On leaves of *Cephalanthus occidentalis*, Kansas (Kellerman).

25. CERCOSPORA GYMNOCLOADI, E. & K. 1. c.

Mostly epiphyllous on suborbicular, grayish brown spots (3—4 mm.) with a discolored border. Hyphæ in minute punctiform tufts, simple, continuous, brown, 18—25 x 4  $\mu$ . Conidia obclavate-cylindric, brown, 3—6 septate, 45—60 x 5—6  $\mu$ , but often much shorter (25—35  $\mu$ ), 2—3-septate and occasionally constricted at the septa.

On leaves of *Gymnocladus Canadensis*, Kansas (Kellerman).

26. CERCOSPORA OMPHAKODES, Ell. & Hol. Jour. of Mycol. I, p. 5.

Amphigenous but more abundant below, on round (5—6  $\mu$ ) brown spots which are mostly included in pale-brown dead areas of the leaf. Hyphæ brown, continuous or faintly septate, abruptly bent, subgeniculate and imperfectly dentate above, 60—75 x 3  $\mu$ ; conidia brownish, cylindrical, mostly about 50—60 x 3—3½  $\mu$ , faintly 5—6-septate.

On leaves of *Phlox divaricata*, var. *Laphami*. Aug. Iowa (Holway).

The specific name alludes to the tardy maturing of the conidia which remain for some time granular and faintly 1—2-septate.

27. CERCOSPORA CIRCUMSCISSA, Sacc., Fungi Ven., nov. V. p. 189. *C. graphioides*, Ell. N. A. F. 646..

Spots round, rusty brown (3—4 mm.) becoming pallid, with a definite concolorous margin surrounded mostly with a red shaded border. Hyphæ amphigenous but mostly hypophyllous, in slender, erect, black, bristle-like fascicles scattered over the surface of the spots, subnodulose and subflexuous above (50—75 x 3  $\mu$ ) dark brown, continuous or faintly septate and united below in a black tubercular base. Conidia obclavate, 50—75 x 3½—4  $\mu$ , mostly about 3-septate, black-brown.

On leaves of *Prunus serotina*, Newfield, N. J. Autumn.

It is not absolutely certain that *C. circumscissa*, Sacc., and *C. graphioides*, Ell., are the same, but the probability of their identity is so strong that, for the present at least, we leave the latter as a synonym.

28. CERCOSPORA CONCENTRICA, C. & E., Grev. V. p. 90. *C. Yuccæ*, Ck. Grev. VII. p. 35. Rav. F. Am., no. 290.

Spots large, round or elliptical, ferrugineous, brown becoming gray. Tufts erumpent in subcircinating, tubercular pustules which have been found to be the perithecia of a *Sphæria* having biseriate, fusoid, hyaline, 1—2-septate, sporidia 12—15 x 2—2½  $\mu$ , allied to *Diaporthe gloriosa*, S. & S. The hyphæ of the *Cercospora* spring directly from these perithecia and are short (12—20 x 4  $\mu$ ), brown, simple, and continuous, bearing conidia at first hyaline and cylindrical but at length quite distinctly reddish brown, attenuated above 1—5-septate, and 40—70 x 3—4  $\mu$ .

On living leaves of *Yucca filamentosa*, Newfield, N. J. *C. Yuccæ*, on *Y. gloriosa*, Ga. (Ravenel.)

Having carefully examined and compared the original specimens, we consider the two species above cited as specifically the same. The specimens of *C. Yuccæ* have the spots rusty brown, which is also true of *C. concentrica* in the young state. We find the hyphæ in both short.

29. *CERCOSPORA HETEROMELES*, Hark. Bull. Cal. Acad. Sci., Feb. 1884, p. 38.

Hypophyllous, on reddish brown, suborbicular, definitely limited spots ( $\frac{1}{4}$ — $\frac{3}{4}$  cm.) with a narrow, raised border; hyphæ very short, brown, arising from a broad (60—80  $\mu$ ), black, tubercular base; conidia subcylindrical, attenuate above, brown, 5—13-septate, 100—130 x 6  $\mu$ . Sometimes the spots are confluent over large areas of the leaf; they are also mostly of a lighter color above (grayish), and often with a dull white spot included in the brown.

On leaves of *Heteromeles arbutifolia*, Berkeley, Cal. Sept. (Harkness.)

30. *CERCOSPORA POLYGONACEA*, E. & E. N. A. F. 1254.

On dark brown spots (2—3 mm.) with a slightly raised, narrow border, around which the leaf is often of a rusty brown, or the whole of the leaf or that part of it including the spots becoming rusty brown and dead. Hyphæ mostly epiphyllous, 80—112 x 4  $\mu$ , brown, faintly septate, subgeniculate and imperfectly incise-toothed above. Conidia linear-obclavate, hyaline, rather faintly multiseptate, mostly 80—100  $\mu$  long, but exceptionally reaching twice that length.

On leaves of *Polygonum Convolvulus*, Newfield, N. J. Aug. Quite distinct from *C. Polygonorum*, Cke.

31. *CERCOSPORA PENTSTEMONTIS*, E. & K. Bull. Tor. Bot. Club, XI, p. 121.

Amphigenous, on orbicular (.25—.5 cm.), purplish brown spots (whitening out), with a narrow, raised border surrounded by a purplish discoloration; hyphæ brown, continuous, nearly straight, subattenuated and more or less denticulate above, 25—35 x 3  $\mu$ , forming dark tufts 70 x 80  $\mu$  across, and thickly scattered over the spots. Conidia brownish, swollen or enlarged above, 2—2.5  $\mu$  thick, and, with the slender filiform base, 40—75  $\mu$  long, nucleate, becoming faintly 1—3-septate. The slender base of the conidia is abnormal and may result from imperfect development. The same was observed in *C. oculata*, and *C. tuberosa*.

On *Pentstemon cobæa* the hyphæ are more robust and as well as the conidia darker than on *P. grandiflora*.

32. *CERCOSPORA ILICIS*, Ell. Bull. Tor. Bot. Club, VIII, p. 65.

Seated on small (2—3 mm.) brown spots which are limited by a narrow, raised border. Hyphæ amphigenous, tufted, septate, subnodulose, 50 x 70  $\mu$  long. Conidia terminal, obclavate-cylindrical, hyaline, nucleate and at length 1—3-septate, 35—50  $\mu$  long.

On living leaves of *Ilex glabra*, Newfield, N. J., July.

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